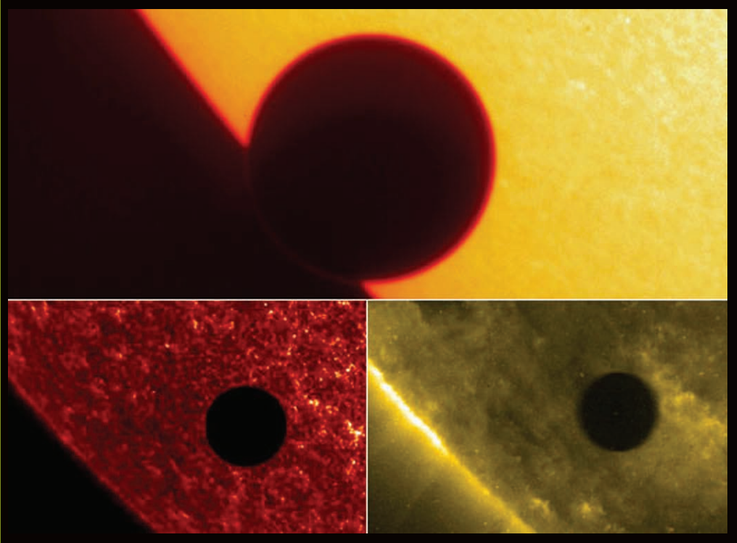
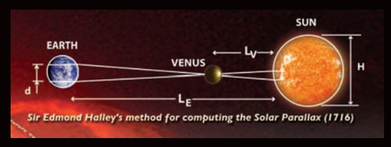


On June 5, 2012 at sunset on the East Coast of North America and earlier for other parts of the U.S., you will see the planet Venus as it moves across the face of the sun. The last time this event occurred was on June 8, 2004 when it was watched by millions of people across the world. For over 100 years the main quest of astronomers was to pin down the distance between Earth and Sun (the Astronomical Unit), which would give them a key to the size of the solar system. Careful studies of the transit of Venus became the gold mine they would harvest to reveal this measure. This event will not occur again until 2117.



Sir Edmond Halley's method for computing the Solar Parallax (1716)

How often do eclipses occur? There will be 36 solar eclipses from 2001-2025 of which 15 will be total eclipses on some part of Earth's surface – a little less than the average of one a year. The common myth that eclipses don't occur very often has evolved because seeing a total eclipse from a specific point on the surface of Earth is not common. Most people think that solar eclipses are quite rare but there are actually two to five eclipses every year. They only seem rare because each eclipse can only be seen from a small part of Earth. The next total solar eclipse visible in North America will occur in 2017 (see map below).

The Sun-Earth Day community is taking full advantage of today's digital and social media tools. Connect with NASA scientists, educators and Sun-Earth Day fans from around the globe!

Twitter: http://twitter.com/SunEarthDay
Facebook: http://www.facebook.com/SunEarthDayFan
YouTube: http://www.youtube.com/user/SunEarthDay
Podcasts: http://sunearth.gsfc.nasa.gov/podcasts/podrss.xml
Vodcasts: http://sunearthday.nasa.gov/podcasts/vodrss.xml
Space Weather Media Viewer: http://sunearthday.nasa.gov/spaceweather


Eclipse path over United States in 2017.

NP-2011-09-239-GSFC

www.nasa.gov

Shadows of the Sun

SUN-EARTH DAY 2012

Annual Equinox Celebration: March 19, 2012

Transit of Venus Celebration: June 5, 2012

Transit of Venus

June 5-6, 2012

National Aeronautics and Space Administration

1 8 8 2 Philadelphia Enquirer

"Scores of Columbia College students wearing morter boards climbed to the top of the new law-school building to catch a glimpse." (12/6)

1 8 8 2 Boston Daily Globe

"Visit of Venus. She crosses the disk of the God of Day. The spectacle is viewed through telescopes and smoked glass." (12/7)

1 8 8 2 San Francisco Chronicle

"All who missed a view of the transit of Venus are to be commiserated, for should they live to be 100 years old the chance will not come again." (12/7)

1 8 8 2 Scientific American

"It is possibly the last time that so much scientific stress will be laid upon the transit of Venus. For before the next one in 2004, we have faith to believe that other and more accurate methods will be found for computing the sun's distance." (12/16)

Introduction:

Astronomers can use the transit of Venus to determine the distance between the Sun and Earth using a method based on the geometric properties of the Right Triangle.

Objectives:

The students will apply the concepts of vertical angles and trigonometric ratios to calculate lengths and angles. The students will determine congruent angles.

Benchmarks:

6-8 Technology is essential to science for such purposes as access to outer space, sample collection, measurement, storage and computation.

9-12 Distances and angles that are inconvenient to measure directly can be found from measurable distances and angles using scale drawings.

9-12 Find answers to problems by substituting numerical values in simple algebraic formulas.

Materials:

Student Worksheets, Scientific Calculator – degree mode

Prior Knowledge:

Vertical angles, Trigonometric ratios, Radius, Diameter

Procedure:

Step 1: Teacher provides the students with the Student Worksheet. The students complete Problem 1 and Problem 2. Teacher and students discuss the answers to Problem 1 and Problem 2.

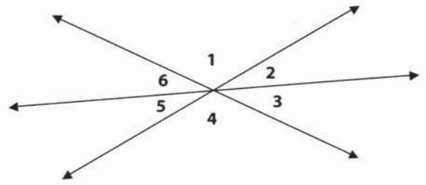
Step 2: Teacher and students discuss how Problem 3 is created from Problem 2. The students answer Problem 3 and the teacher and students discuss the answers.

Step 3: Teacher and students discuss how the drawing in Problem 3 was turned and changed to create the drawing in Problem 4. Teacher can guide the students through the questions for Problem 4 or provide time for the students to complete Problem 4. Discuss the answers to the questions.

Step 4: Teacher and students discuss and answer Problem 5.

Problem 1

Using the diagram below, solve the following problems.

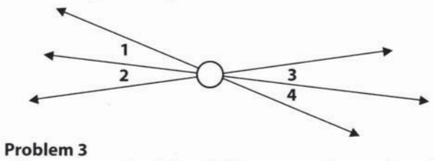


$\angle 1 \cong \angle \_\_$ $\quad \angle 2 \cong \angle \_\_$

$\angle 6 \cong \angle \_\_$ $\quad \angle 1 + \angle 6 = \angle \_\_ + \angle \_\_$

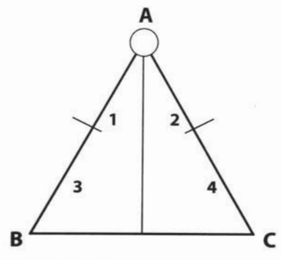
Problem 2

Next, picture the Sun in the Center of the angles below. List the congruent angles.



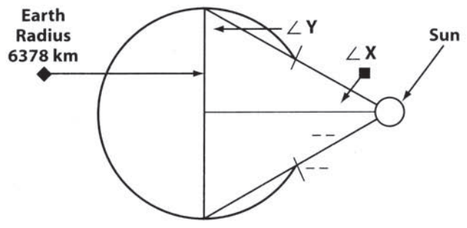
Problem 3

Now, suppose that $\angle 1$ and $\angle 2$ connect to form an isosceles triangle and the Sun is at the top vertex. List all congruent angles and congruent sides.



Problem 4

Suppose that the isosceles triangle was rotated 90 degrees clockwise. Picture the base of the triangle intersecting the Earth. (Note: not to scale)

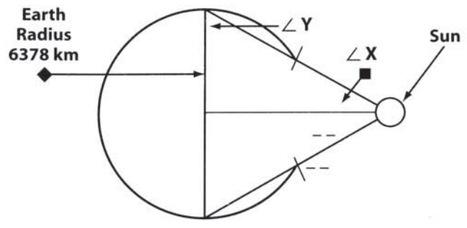


What is the Earth's diameter?

If the distance from the Earth to the Sun is 150,000,000 km, what is the measure of $\angle X$?

Problem 5

Can the measure of $\angle Y$ be determined? Explain your reasoning.



The Earth's radius is 6378 km and $\angle X$ is 0.00244 degrees, is it possible to mathematically determine the distance to the Sun?

Teacher Answer Page

Problem 1

$\angle 1 \cong \angle 4$
$\angle 6 \cong \angle 3$
$\angle 2 \cong \angle 5$
$\angle 1 + \angle 6 = \angle 4 + \angle 3$

Problem 2

$\angle 1 \cong \angle 4$
$\angle 2 \cong \angle 3$
$\angle 1 + \angle 2 \cong \angle 3 + \angle 4$

Problem 3

$\angle 1 \cong \angle 2$
$\angle 3 \cong \angle 4$
Side AB $\cong$ Side AC

Problem 4

*What is the Earth's diameter? 6378 * 2 = 12756.*
If the distance from the Earth to the Sun is 150, 000,000 km, what is the measure of $\angle X$?

$\text{Tan } X = \frac{6378}{150{,}000{,}000}$ $\qquad$ Inverse Tangent of $\left(\frac{6378}{150{,}000{,}000}\right)$

Angle X = 0.00244

Problem 5

Can the measure of $\angle Y$ be determined? Explain your reasoning.
The only information that is provided is the Earth's radius.
Based on this, the measure of angle Y can not be determined.
In order to determine angle Y, either the measure of angle X or the length of another side would have to be known.

The Earth's radius is 6378 km and $\angle X$ is 0.00244 degrees, is it possible to determine the distance to the Sun?
Yes, it is possible to determine the distance to the Sun by using the tangent ratio.
Tan (0.00244) = 6378 / (the distance to the Sun)
*Tan (0.00244) * (the distance to the Sun) = 6378 km*

$\text{The distance to the Sun} = \frac{6378}{\text{Tan } (0.00244)}$

The distance from the Earth to the Sun is approximately 150,000,000 km

In addition, $\angle Y = 90.0 - \angle X = 89.99756$

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